

## P E T I T I O N

1 Commissioner for Patents  
Alexandria, VA 22313

Your Petitioner, JAMES M. ALLEN, a citizen of the United States and a resident  
of the State of Nebraska, whose post office address is 623 Pier 2, Lincoln, Nebraska  
5 68528, prays that Letters Patent may be granted to him for a

### SYSTEM FOR COATING PARTICULATE WITH A FLUID

as set forth in the following specification.

### BACKGROUND OF THE INVENTION

10 The present invention relates to systems for coating particulate matter and more  
specifically to systems for coating particulate matter with one or more temperature-  
sensitive materials.

### DESCRIPTION OF THE PRIOR ART

15 Several different industries require the coating or impregnation of particulate  
material with one or more types of fluid materials. In agriculture, for example, it is often  
desirable to impregnate bulk dry fertilizer with one or more various liquid compositions,  
such as a herbicide. Oftentimes in these instances, the dry particulate can be held  
within a large mixing container, and the fluid can be applied to the particulate matter  
20 while the container mixes the particulate matter. However, this can be somewhat  
difficult when the impregnating fluid is solid at room temperature. In such instances, the  
container holding the impregnating material must be heated before the material is  
applied to the particulate matter. For small operations, this may not pose much of a  
25 challenge when a single batch is mixed for a single use. Typically, however, it may be

desirable to impregnate large quantities of particulate material in a short amount of time. Moreover, it may be desirable to impregnate the dry particulate material with more than one liquid. In these instances, a large impregnation facility is typically required. However, such systems are often highly complex, which increases the cost to assemble, operate, and maintain the systems.

Large impregnation facilities have typically employed a large mixing vessel, a plurality of heated containers of impregnation material, and a complex array of actively heated lines to deliver the impregnation material to the mixing vessel. The heated lines are typically necessary because the impregnation material begins to cool as soon as it leaves the heated container. Accordingly, when the mixing and impregnating operation is stopped, the user is left with a substantial length of line between the mixing vessel and the heated container that is filled with rapidly cooling impregnation material. If the user waits too long before resuming the mixing and impregnating process with another batch of material, the impregnating material will cool to the ambient temperature and solidify within the lines. Frequently, users will employ heated valves and nozzles to prevent the necessity of tearing apart the system to clean intricate moving parts that have simply held the impregnating material too long. Accordingly, as heated lines, valves, and nozzles are included within systems, they become more complex and costly to operate.

In operations that use one impregnating fluid within one batch, contamination is rarely a problem. Once the dry particulate material is impregnated with the first liquid impregnating material, the operator can simply connect the next container of

1 impregnating material and proceed with the impregnating process. However, where the  
user completes an impregnation operation and then must mix and impregnate a  
different dry particulate material with a different impregnating fluid, cross-contamination  
may become a serious concern. Accordingly, any non-heated lines, valves, and  
5 nozzles must be disassembled and cleaned prior to commencing the new operation.  
This only serves to waste the user's valuable time and resources. However, it is  
oftentimes more efficient to go through the elaborate cleaning process between  
operations than it would be to assemble two completely separate mixing and  
impregnating stations.

10 Accordingly, what is needed is an impregnating system that is capable of  
repeatedly impregnating dry particulate with temperature-sensitive impregnating  
materials that is also simple in construction, operation and maintenance.

#### SUMMARY OF THE INVENTION

15 The system for coating particulate matter with temperature-sensitive materials of  
the present invention is provided with one or more containers that hold different  
impregnating materials. When a particular impregnating material is solid at room  
temperature, a heat-generating assembly will be coupled with the containers to liquefy  
the impregnating material. A supply line extends from each container to a spray  
20 manifold that is coupled to a large mixing vessel. A return line is provided for each  
container and couples the spray manifold and supply line to the container in order to  
create a continuous loop through which the impregnating material can travel. Such a  
continuous loop is provided for each separate container of impregnating material, and

1 particularly where different impregnating materials are used and cross-contamination is  
a concern.

5 Pumps are placed in communication with each separate continuous loop to  
deliver the impregnating material through each continuous loop. Accordingly, where a  
temperature-sensitive impregnating material is used, it leaves its container within a  
specified temperature range, travels out toward the mixing vessel, returns via the return  
line and is re-deposited within the heated container before the impregnating material  
has a chance to cool and solidify within the lines. Valves positioned adjacent the  
manifold allow the user to selectively apply one or more impregnating fluids to the dry  
10 particulate within the mixing vessel. In this manner, the impregnating fluid never  
hardens within the lines, and the separate continuous loops provide for a lack of cross-  
contamination.

15 A scale is disposed beneath each of the heated containers, and a reading is  
taken prior to commencing any impregnating operation. Accordingly, as the user  
begins a new operation, the scale is simply read until a sufficient amount of the  
impregnating material has left the container, resulting in a lighter reading on the scale.

20 Where long distances between the heated containers and the mixing vessel  
need to be traveled, insulated supply and/or return lines can be used. However, the  
system lends itself to ease of use without the necessity of heated lines, valves or  
nozzles and other complex or expensive equipment.

25 Accordingly, a principal object of the present invention is to provide a system for  
coating particulate matter with one or more temperature-sensitive materials.

1 A further object of the present invention is to provide a system for coating  
particulate matter with a plurality of different materials without cross-contamination.

5 Still another object of the present invention is to provide a system for coating  
particulate matter with temperature-sensitive materials without the necessity of heated  
lines, valves, and/or nozzles.

Yet another object of the present invention is to provide a system for coating  
particulate matter with a fluid that incorporates a simple and inexpensive metering  
system.

10 Still another object of the present invention is to provide a system for coating  
particulate matter with temperature-sensitive materials that is simple in assembly and  
use.

15 Yet another object of the present invention is to provide a system for coating  
particulate matter with temperature-sensitive materials that is inexpensive to assemble,  
use and maintain.

These and other objects will be apparent to those skilled in the art.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 Figure 1 is a schematic of one possible embodiment of the system of the present  
invention; and

25 Figure 2 is a perspective view of an embodiment of the output nozzle manifold of  
the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

1       The particulate coating/impregnating system 10 of the present invention is  
generally depicted in Figure 1 in one preferred embodiment. Although the system 10  
will generally be described as it could be used in the agricultural field for impregnating  
5       dry particulate fertilizer with temperature-sensitive materials, such as many known  
herbicides, it is contemplated that the system 10 could be used in nearly any industry  
for nearly any type of coating and/or impregnating operation. For example, it is  
contemplated that the system 10 could be used for the coating of small rock particulate  
with a tar-based material. Accordingly, the particular uses and configurations set forth  
10       herein are intended for the ease of description only and should not be considered to be  
limiting in any manner.

      The system 10 will typically be provided with one or more containers to hold the  
impregnating material. In Figure 1, the embodiment depicted is shown with a first  
15       container 12, a second container 14, and a third container 16. Separate supply lines  
are disposed within each container. As depicted, supply lines 18, 20 and 22 are  
disposed within and extend outwardly from containers 12, 14 and 16, respectively. The  
supply lines travel outwardly to the mixing vessel 24, which may be positioned adjacent  
to or remotely from the containers. Return lines 26, 28 and 30 are run from the vessel  
20       24 to containers 12, 14 and 16, respectively, in order to form continuous loops  
associated with each container. Pumps 32, 34 and 36 are each coupled to a separate  
continuous loop to deliver the impregnating material therethrough.

At least one spray manifold 38 joins the supply lines 18, 20 and 22 with the  
return lines 26, 28 and 30 at the mixing vessel 24. Specifically, a valve, such as valves  
40, 42 and 44 depicted in Figure 1, join their respective supply and return lines with the  
manifold 38. A spray nozzle 46 is coupled to the terminating end of the manifold 38  
and is positioned to spray into the vessel 34 and onto the mixing dry particulate therein.  
It is contemplated that one of several known mixing assemblies could be used within  
the vessel 24 to continuously mix the dry particulate as the impregnating fluid is applied.  
For large operations, it is contemplated that a plurality of manifolds could be used and  
spaced apart from one another to provide an even application. Figure 1 depicts the use  
of a second manifold 48, which is assembled and operated in much the same manner  
as manifold 38.

Valves 50, 52 and 54 are mated with the return lines 26, 28 and 30, respectively.  
In operation, valves 50, 52 and 54 would typically remain open while the valves  
associated with manifolds 38 and 48 would be closed. In this configuration, the pumps  
32, 34 and 36 circulate the impregnating fluids from containers 12, 14 and 16  
throughout their respective continuous loops. Accordingly, the impregnating material is  
continuously recycled through the containers and their supply lines. This will be  
particularly relevant where temperature-sensitive impregnating materials are used. For  
example, many contemporary liquid herbicides are provided in 55-gallon drums and are  
the consistency of peanut butter at room temperature. Accordingly, in order to liquefy  
the herbicide, it is necessary to heat the containers to approximately 150°. However, it  
is contemplated that different coating/impregnating materials will require different

temperatures to maintain their liquid state. Accordingly, it is preferred that each  
1 separate container be provided with a separate means for heating the same. Once  
such means, depicted in Figure 1, incorporates the use of heating belts 56 around the  
perimeter of each of the containers. Each pair of heating belts 56 can be set to warm  
5 its associated container to the appropriate temperature range. It is contemplated,  
however, that other heating means, including warming blankets, warming coils disposed  
within the impregnating material, and even warming baths (in which the individual  
containers could be disposed) could be used. For example, as the impregnating  
material leaves container 12 through supply line 18, it is at or above the temperature  
10 needed to keep the material in a fluid state. The impregnating material travels through  
manifolds 38 and 48, returning through the return line 26 and re-entering the container  
12. In this arrangement, the impregnating material continuously recycles to remain  
within the appropriate temperature range. Where longer runs of supply lines and return  
15 lines must be used, it is contemplated that insulated lines could be incorporated within  
the system. However, a layer of insulation could be applied to any line deemed  
necessary after assembly of the system.

When it is desired to apply the impregnating material to the dry particulate within  
the vessel 24, valves 50, 52 and/or 54 are closed; and the valves 40, 42 and 44 (and  
20 the associated valves in other system manifolds, such as manifold 48) are opened.  
The pressure generated by pumps 32, 34 and/or 36 generate sufficient pressure within  
their associated loops to dispense the impregnating material into the manifolds, through  
the nozzles, and into the mixing vessel 24. To more accurately regulate the amount of  
25



1 impregnating material being applied, a scale 58 could be positioned to support each of  
the containers 12, 14 and 16. The scale display 60 would be "zeroed" prior to  
commencing the application of the impregnating material. Then, after the repositioning  
of the proper valves, the scale could be read until a sufficient volume of impregnating  
5 material had left the system and thus lowered the reading from the scale to a desired  
level. At that point, the valves are reversed, using a simple manual valve actuation  
system 62 or other known automated means. The valves 40, 42 and 44 in the manifold  
38 are shut (and those associated with any other manifold in the system), and the  
relevant valves 50, 52 and/or 54 are opened. In this position, the impregnating material  
10 resumes its recirculation in order to maintain its liquid temperature.

Preferably, the system 10 will be provided with a container filled with an  
appropriate cleaning agent for the removal of unwanted impregnating material from the  
manifolds 38 and 48 and the mixing vessel 24. For example, container 12 could be  
15 provided with the cleaning agent, which would be pumped through supply line 18 by the  
pump 32 into the manifold 38. With the associated valve 40 open, the cleaning agent  
travels through the manifold, past valves 42 and 44, and through the nozzle 46 into the  
mixing vessel 24. In this manner, each path taken by impregnating materials traveling  
from containers 14 or 16 is cleaned. With the manifolds and mixing vessel clean, the  
20 valves 50 and 40 would be reversed, and a new operation could be commenced with a  
different impregnating material without fear of cross-contamination from previously used  
impregnating materials.

1 In the drawings and in the specification, there have been set forth preferred  
embodiments of the invention; and although specific items are employed, these are  
used in a generic and descriptive sense only and not for purposes of limitation.  
Changes in the form and proportion of parts, as well as substitution of equivalents, are  
5 contemplated as circumstances may suggest or render expedient without departing  
from the spirit or scope of the invention as further defined in the following claims.

Thus it can be seen that the invention accomplishes at least all of its stated  
objectives.